

Investigating the future changes of extreme precipitation indices in Asian regions dominated by south Asian summer monsoon

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Abstract

The impact of global warming on the south Asian summer monsoon is of critical importance for the large population of this region. This study aims to investigate the future changes of the precipitation extremes during pre-monsoon and monsoon, across this region in a more organized regional structure. The study area is divided into six major divisions based on the Köppen-Geiger's climate structure and 10 sub-divisions considering the geographical locations. The future changes of extreme precipitation indices are analyzed for each zone separately using five indices from ETCCDI (Expert Team on Climate Change Detection and Indices); R10mm, Rx1day, Rx5day, R95pTOT and PRCPTOT. 10 global climate model (GCM) outputs from the latest CMIP6 under four combinations of SSP-RCP scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5) are used. The GCMs are bias corrected using nonparametric quantile transformation based on the smoothing spline method. The future period is divided into near future (2031-2065) and far future (2066-2100) and then the changes are compared based on the historical period (1980-2014). The analysis is carried out separately for pre-monsoon (March, April, May) and monsoon (June, July, August, September). The methodology used to compare the changes is probability distribution functions (PDF). Kernel density estimation is used to plot the PDFs. For this study we did not use a multi-model ensemble output and the changes in each extreme precipitation index are analyzed GCM wise. From the results it can be observed that the performance of the GCMs vary depending on the sub-zone as well as on the precipitation index. Final conclusions are made by removing the poor performing GCMs and by analyzing the overall changes in the PDFs of the remaining GCMs.

Keywords : Extreme precipitation indices, Probability distribution functions, Monsoon, Köppen-Geiger's climate zones

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